REMARKS

SECTION 101 REJECTIONS

REJECTION UNDER 35 U.S.C. §101

In the Final Office Action, claims 14-29 were rejected under 35 U.S.C. §101 because the claims were said to be directed to non-statutory subject matter. In particular, claims 14-29 were rejected because Applicants' description of computer-readable media included magnetic carrier waves.

With the present amendment, claim 14 has been amended to change "computer-readable medium having" to "computer-readable storage medium storing." In the specification on page 7, lines 11-13, computer-readable media was said to comprise computer storage media and communication media. Computer storage media was further said to include RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or other media which can be used to store the desired information and which can be accessed by computer 110. (See page 7, lines 18-26). Communication media, on the other hand, were said to include instructions and data structures in a modulated data signal such as a carrier wave or other transport mechanism. (See page 7, lines 26-30). Thus, in the specification, a distinction is made between computer-readable storage media and computer-readable communication media with computer-readable storage media being directed to tangible computer-readable media and communication media said to include carrier waves. Since a computer-readable storage medium is directed to a tangible computer-readable medium and not carrier waves, the amendments to claim 14 exclude communication media, such as carrier waves, and thus make claim 14 statutory.

SECTION 102 AND 103 REJECTIONS

CLAIMS 1-11

Claims 1, 2, 5, 6 and 10 were rejected under 35 U.S.C. §103(a) as being unpatentable over the admitted prior art (APA). Claims 3 and 4 were rejected under 35 U.S.C. §103(a) as being unpatenable over the admitted prior art in view of Frey et al. (U.S. Patent Publication

2002/0173953, hereinafter Frey) and further in view of Zangi et al. (U. S. Patent Publication 2004/0111258, hereinafter Zangi). Claims 7-9 and 11 were rejected under 35 U.S.C. §103(a) as being unpatentable over the APA in view of Zangi et al. (U.S. Patent 7,162,420, hereinafter Zangi '420).

Claim 1 is directed to a method of determining an estimate for a noise-reduced value representing a portion of a noise-reduced speech signal. The method includes generating an alternative sensor signal using an alternative sensor other than an air conduction microphone. The alternative sensor signal is converted into at least one alternative sensor vector and a weighted sum of a plurality of correction vectors is added to the alternative sensor vector to form the estimate for the noise-reduced value.

With the present amendment, claims 3 and 4 have been added to claim 1 and claims 3 and 4 have been canceled. As amended, claim 1 is not shown or suggested in the combinations of cited art. In particular, none of the cited references show or suggest adding a weighted sum of a plurality of correction vectors to an alternative sensor vector to form an estimate of a noise-reduced value, wherein each weight is based on a probability of the correction vector's mixture component.

In the Office Action, Figure 4 of Frey was asserted to show weights based on the probability of a correction vector's mixture component given an alternative sensor vector. Applicants respectfully dispute this assertion.

Frey does not show or suggest forming a weighted sum of correction vectors. Instead, Frey determines a combination of clean speech, noise and channel distortion that has the highest posterior probability given a noisy feature vector for each of a set of mixture components. The clean speech values estimated for each mixture component are then combined by forming a weighted sum of the clean speech values. (See Equation 12) Since Frey computes the clean speech value directly from the posterior probability, it does not use correction vectors and as such does not show a weighted sum of correction vectors. In addition, the weighted sum used in Frey does not use weights that are based on the probability of a correction vector's mixture component given an alternative sensor vector. Because Frey does not use correction vectors, it does not

show a mixture component that corresponds to a correction vector or a weight that is based on a probability of such a mixture component given an alternative sensor signal. Likewise, none of the other cited references shows or suggests forming a weighted sum of correction vectors where each weight is based on the probability of a mixture component given an alternative sensor vector. As such, claim 1, and claims 2 and 5-11, which depend therefrom, are patentable over the cited art.

CLAIMS 12 AND 13

Claims 12 and 13 were rejected under 35 U.S.C. §103(a) as being unpatentable over Park et al. (U.S. Patent 5,590,241, hereinafter Park) in view of the APA.

In claim 12, a method of determining an estimate of a clean speech value is provided. The method includes receiving an alternative sensor signal from a sensor other than an air conduction microphone and receiving an air conduction microphone signal from an air conduction microphone. A pitch for a speech signal is identified based on the alternative sensor signal. The pitch is used to decompose the air conduction microphone signal into a harmonic component and a residual component by modeling the harmonic component as a sum of sinusoids that are harmonically related to the pitch. The harmonic component and the residual component are then used to estimate the clean speech value by determining a weighted sum of the harmonic component and the residual component.

With the present amendment, claim 12 has been amended. Support for the amendments can be found on page 30, lines 2-8 and page 34, line 14 through page 35, line 6.

As amended, claim 12 is not shown or suggested in the cited art. In particular, none of the cited art shows or suggests decomposing an air conduction microphone signal into a harmonic component and a residual component by modeling the harmonic component as a sum of sinusoids that are harmonically related to the pitch and then determining a weighted sum of the harmonic component and the residual component to estimate a clean speech value.

In the admitted prior art cited by the Examiner, the spectrum of noise is estimated by looking at valleys between peaks in the spectrum and the spectrum of noise is then subtracted

from the spectrum to produce a clean signal estimate. However, this subtraction does not involve a weighted sum of a harmonic component and a residual component and does not model the harmonic component as a sum of sinusoids that are harmonically related to the pitch. Similarly, Park does not show or suggest determining a weighted sum of a harmonic component and a residual component to estimate a clean speech value. As such, the combination of cited references does not show or suggest the invention of claim 12 or claim 13, which depends therefrom.

CLAIMS 14, 15, 17, 18, 23, 24, 29 AND 30

Claims 14, 19 and 20 were rejected under 35 U.S.C. §102(b) as being anticipated by Park. Claims 15 and 25-27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Park in view of the admitted prior art. Claims 16 and 28 were rejected under 35 U.S.C. §103(a) as being unpatentable over Park. Claims 17 and 18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Park, in view of Frey, in further view of Zangi. Claims 21-24 and 29 were rejected under 35 U.S.C. §103(a) as being unpatentable over Park in view of Zangi.

Claim 14 provides a computer-readable storage medium storing computer-executable instructions for performing a series of steps. The steps include receiving an alternative sensor signal from an alternative sensor that is not an air conduction microphone signal and receiving a noisy test signal from an air conductive microphone. A noise model is generated from the noisy test signal, wherein the noise model comprises a mean and a variance. The noisy test signal is converted into at least one noisy test vector and the mean of the noise model is subtracted from the noisy test vector to form a difference. An alternative sensor vector is formed from the alternative sensor signal and a correction vector is added to the alternative sensor vector to form an alternative sensor estimate of a clean speech value. A weighted sum of the difference and the alternative sensor estimate is set as an estimate of the clean speech value.

With the present amendments, the limitations of claims 19, 20, 21 and 22 have been added to claim 14. In addition, the content of the noise model has been explicitly claimed as comprising a mean and a variance.

As amended, claim 14 is not shown or suggested in the combination of cited art. In particular, none of the cited art sets a weighted sum of a difference between a noisy test vector and a mean of a noise model and an alternative sensor estimate of a clean speech value as an estimate of a clean speech value. Further, none of these cited references show or suggest forming a noise model having a mean and a variance.

In the Office Action, the step of setting a weighted sum of a difference and an alternative sensor estimate of a clean speech value as an estimate of the clean speech value was said to be shown in AP filter 74A to 74M and combiner circuit 76 of Zangi. However, the output of combiner circuit 76 is not an estimate of a clean speech value as found in claim 14. Instead, as shown in paragraph [0111] of Zangi, the intermediate output signal $Z(\omega)$ of combiner 76 is equal to a desired signal plus a noise term $T(\omega)$ due to the noise provided by one or more microphones. Thus, the output of combiner circuit 76 is not an estimate of a clean speech value, but instead is an intermediate signal containing noise. This is different from claim 14 wherein the weighted sum forms a clean signal estimate.

Further, there is no suggestion in any of the cited art for combining a difference between a noisy test signal and a mean of a noise model with an alternative sensor estimate of a clean speech value. In particular, there is no indication of how to set the weights in such a weighted sum and there is no indication of any benefit to forming a weighted sum of such a difference and an alternative sensor estimate of a clean speech value. As such, it would not be obvious to those skilled in the art to form such a weighted sum.

Because none of these cited references show or suggest setting a weighted sum of an alternative sensor estimate of a clean speech value and a difference between the noisy test vector and a mean of a noise model as an estimate of a clean speech value, and since none of the cited art shows or suggests the benefits of such weighting or how the weights should be selected, the combination of cited art doe not show or suggest claim 14.

New claim 30 is additionally patentable over the cited art. Under new claim 30, a weight for the weighted sum is formed based on the variance of the noise model. None of the

cited art shows or suggests forming a weight for such a weighted sum based on the variance of a noise model. As such, claim 30 is additionally patentable over the cited art.

CONCLUSION

In light of the above remarks, claims 1, 2, 4-15, 17, 18, 23, 24, 29 and 30 are in form for allowance. Reconsideration and allowance of the claims is respectfully requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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